Overview Chart

Broadband, Electrically-Tunable, Monolithic Mid-Infrared Laser

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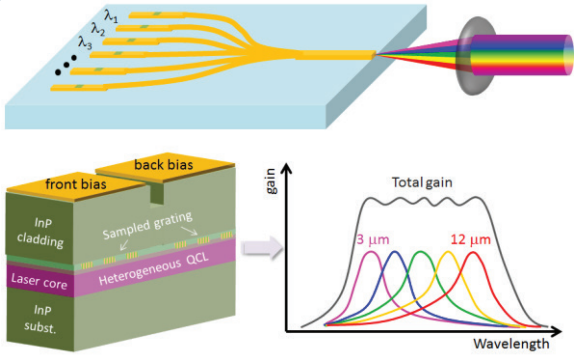

Monolithic tunable laser architecture, discrete laser geometry, and engineered broad gain bandwidth.

Research Objectives:

- To develop a new, broadly tunable mid-infrared diode laser source that is compatible with, yet will significantly improve the versatility of, in situ environmental monitoring instruments on future NASA missions.
- Innovation is based on realizing full functionality in a single chip format.
- Currently, no broadband gain medium has been developed which can cover the full spectrum of interest.
- Commercial tunable lasers are based on larger, mechanical, external cavity designs which have limited tuning speed and are sensitive to mechanical shock.
- Basic component functionality has been demonstrated (TRL 2).
- Integration of components will lead to a functional laboratory demonstration (TRL 3)

Approach:

- Explore functional limits to electrically-tunable quantum cascade lasers
- Engineer a broadband gain quantum cascade laser for both midwave (3-6 µm) and longwave (6-12 µm) infrared spectral regions
- Monolithically integrate tunable lasers onto a single chip capable of tuning across entire spectral range of the gain medium.

Potential Impact:

- Current NASA systems use discrete lasers for detection of one or two chemicals
- The proposed laser source can be a drop-in replacement that can detect any number of chemicals.
- Added functionality will dramatically reduce system complexity while increasing mission scope and cost effectiveness.
- Similar advantages for non-space based applications